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# *Grade 9 Achievement Test Science*

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EDUCATION



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# GRADE 9 ACHIEVEMENT TEST

## SCIENCE

### General Instructions

1. This test has two parts:  
Part A has 60 multiple-choice questions each with a value of one mark.  
Part B has 5 numerical-response questions each with a value of one mark.
2. You have 2 hours to complete this test.
3. The use of approved calculators is recommended.
4. Read each question carefully and follow the specific instructions given.
5. Use **only** an **HB** pencil to mark your answer.

### PART A: MULTIPLE CHOICE

#### Instructions

1. Each question has four possible answers from which you are to choose the **correct** or **best** answer.
2. Mark your choice on the separate answer sheet provided.

#### Example

1. This test is for the subject of

- A. Science
- B. Mathematics
- C. Language Arts
- D. Social Studies

#### Answer Sheet

1.    A    B    C    D  
      ●    ○    ○    ○

3. Mark only one answer for each question. If you change an answer, **erase your first mark completely**.
4. Be sure that the number on the answer sheet matches the number of the question you are doing.
5. Your teacher will tell you when to start and when to stop.



## PART B: NUMERICAL RESPONSE

### Instructions

1. Read each question carefully.
2. Record your answer on the answer sheet by writing it in the boxes and filling in a circle in **every** column.
3. Mark only one answer for each question. If you change an answer, **erase your first mark completely**.
4. Be sure that the number on the answer sheet matches the number of the question you are doing.
5. For each question in Part B, be sure to fill in all **four** boxes and **four** circles, as shown in these examples:

### Examples

1. Following is a list of electrical appliances:

1. refrigerator
2. oven
3. blender
4. toaster

Place these appliances in alphabetical order.

Answer: \_\_\_\_\_, \_\_\_\_\_, \_\_\_\_\_, \_\_\_\_\_

Answer: 3, 2, 1, 4

3	2	1	4
•	•	•	•
0	0	0	0
1	1	●	1
2	●	2	2
●	3	3	3
4	4	4	●
5	5	5	5
6	6	6	6
7	7	7	7
8	8	8	8
9	9	9	9

2. Place the number that matches the animal on the line above its correct name.



1



2



3



4

\_\_\_\_\_, \_\_\_\_\_, \_\_\_\_\_, \_\_\_\_\_  
moose                  goat                  deer                  sheep

Answer: 2, 4, 3, 1


2	4	3	1
•	•	•	•
0	0	0	0
1	1	1	•
•	2	2	2
3	3	•	3
4	•	4	4
5	5	5	5
6	6	6	6
7	7	7	7
8	8	8	8
9	9	9	9

3. A mechanic used a hydraulic press to compress a spring. If the hydraulic press exerts a pressure of  $50.0 \text{ N/cm}^2$  and the surface area of the spring is  $1.25 \text{ cm}^2$ , what is the force exerted on the spring?

Answer: 62.5 N (newtons)

6	2	.	5
•	•	•	•
0	0	0	0
1	1	1	1
2	•	2	2
3	3	3	3
4	4	4	4
5	5	5	•
•	6	6	6
7	7	7	7
8	8	8	8
9	9	9	9

*Do not turn this page until your teacher tells you to do so.*



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## BIRD SANCTUARY

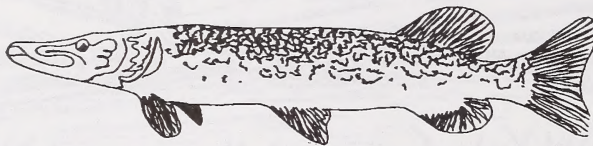


Kayla works in a bird sanctuary in southeastern Alberta. The first nine questions are about this bird sanctuary.

1. Kayla listened to a naturalist talk about the unique species that live in the bird sanctuary. The naturalist correctly defined the word “species” as a group of organisms that
- A. live in the same habitat
  - B. adapt to environmental changes
  - C. have both exoskeletons and skeletons
  - D. are able to interbreed and produce young

*Use the following information to answer question 2.*

These organisms are found near or in a lake.



Pike



Robin



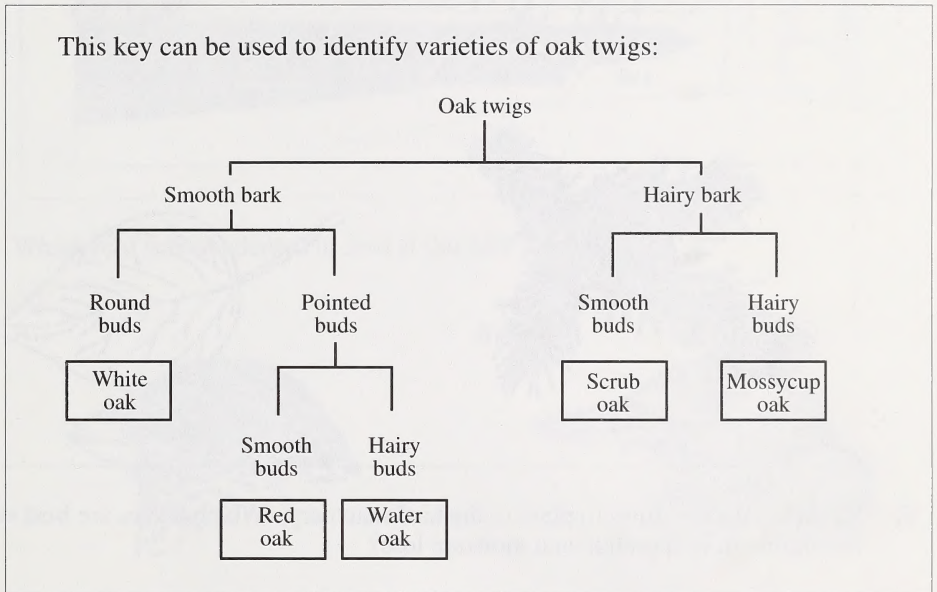
Snail

2. Kayla learned that a pike is more closely related to a robin than it is to a snail. Which feature does the snail lack that the pike and the robin both have?
- A. Backbone
  - B. Warm bloodedness
  - C. Nervous system
  - D. Digestive system



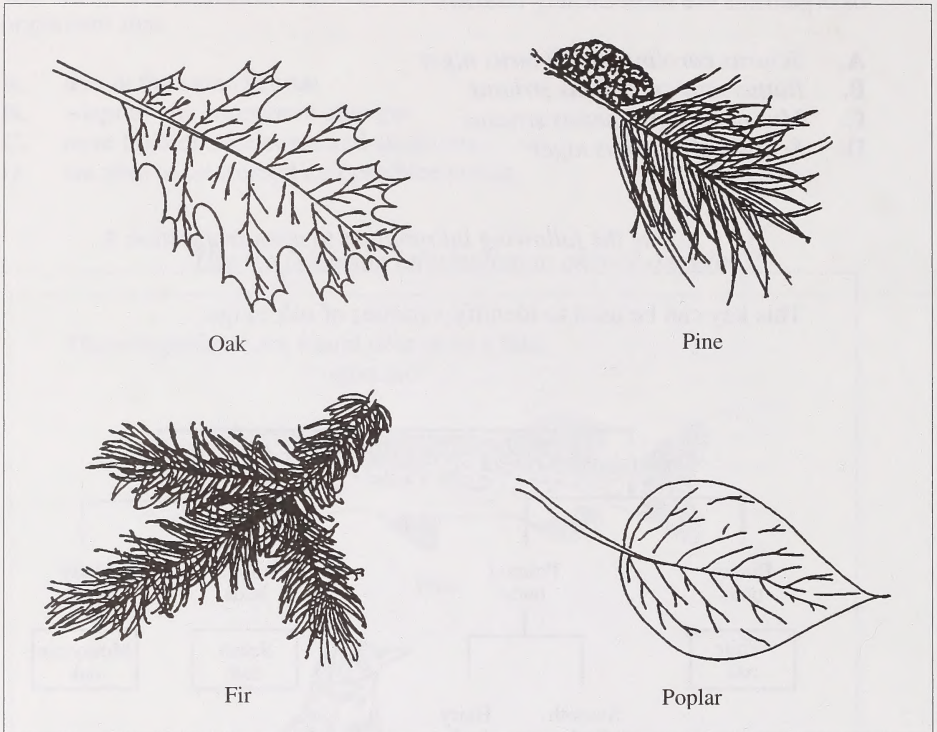
3. Kayla found a number of different organisms that have similar names. Which pair of organisms are **most** closely related?
- A. *Sciurus carolinensis*, *Sciurus niger*
  - B. *Rattus tamias*, *Tamias striatus*
  - C. *Mus musculus*, *Tamias striatus*
  - D. *Sciurus niger*, *Mus niger*

Use the following information to answer question 4.



4. Kayla wants to identify an oak tree by the lake. To find out whether the tree is a water oak or a mossycup oak, which is the **best** question for Kayla to ask?
- A. What is the color of the tree?
  - B. Are the buds round or pointed?
  - C. Are the buds smooth or hairy?
  - D. Is the bark smooth or hairy?

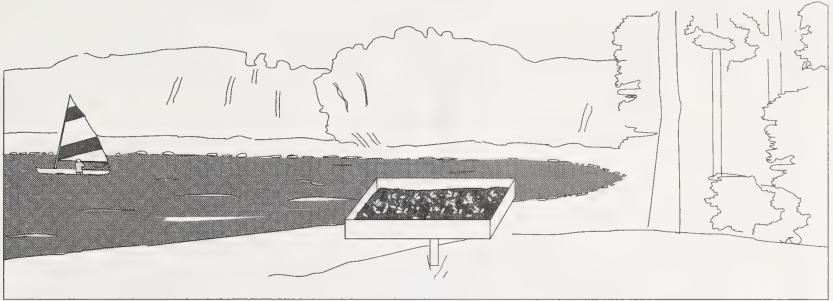
Use the following information to answer question 5.



5. Kayla is selecting trees to plant in the bird sanctuary. Which leaves are **best** suited for minimum evaporation and moisture loss?
- A. Oak and poplar
  - B. Poplar and fir
  - C. Pine and oak
  - D. Fir and pine

Use the following information to answer question 6.

Kayla made a new bird feeder. She filled it with seeds and put it on some grass close to the lake.



6. Which bird is **best** adapted to feed at this bird feeder?

A.



B.



C.



D.





Use the following information to answer question 7.

Kayla's two assistants, Rita and Bob, are clearing a swimming area in the lake. After numerous experiments, they conclude that it is easier to carry the rocks using Bob's method than Rita's method.



7. Rita and Bob also discussed adding salt to the water, but they discarded this method for practical and environmental reasons. They thought of adding salt because they knew that there is an increase in buoyant force when there is
- A. an increase in a fluid's density
  - B. a decrease in a fluid's density
  - C. an increase in temperature
  - D. a decrease in temperature

*Use the following information to answer question 8.*

Kayla wants to drain the fish aquarium located in the exhibit building. She has a large bucket and a long flexible hose. She places one end of the hose in the aquarium water.

8. Where should Kayla place the other end of the hose in order to siphon the water out of the aquarium?
- A. Above the aquarium
  - B. Below the aquarium
  - C. Directly opposite the top of the aquarium
  - D. Directly opposite the water level in the aquarium
- 

*Use the following information to answer question 9.*

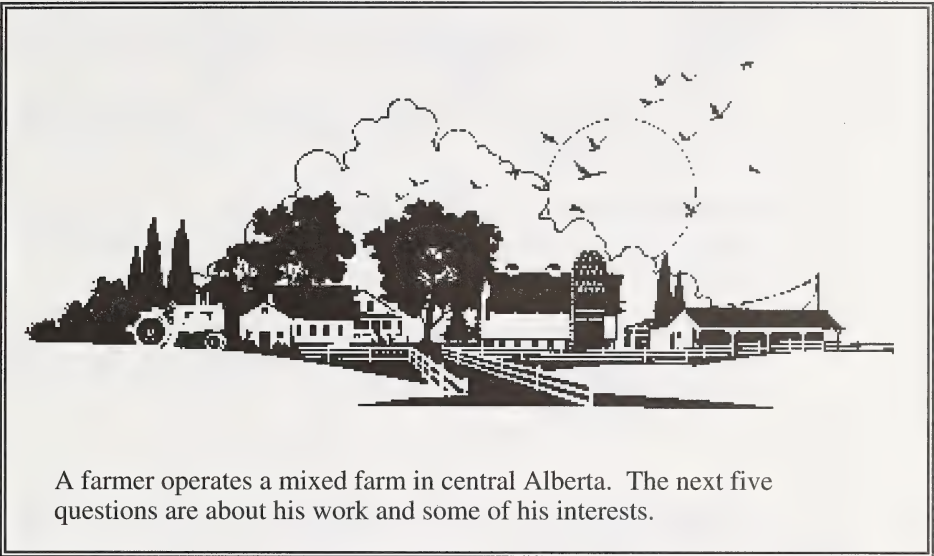
When Kayla walked across the lake one winter, the ice began to crack. She immediately lay flat on the ice and then slowly crawled out of danger.

9. Which statement **best** explains why Kayla lay flat on the ice?
- A. She wanted to minimize her fall through the ice.
  - B. She wanted to distribute her weight closer to the ice.
  - C. She wanted to distribute her weight over an increased area.
  - D. She wanted to minimize her force by lowering her weight closer to the ice.





## FARMING



A farmer operates a mixed farm in central Alberta. The next five questions are about his work and some of his interests.

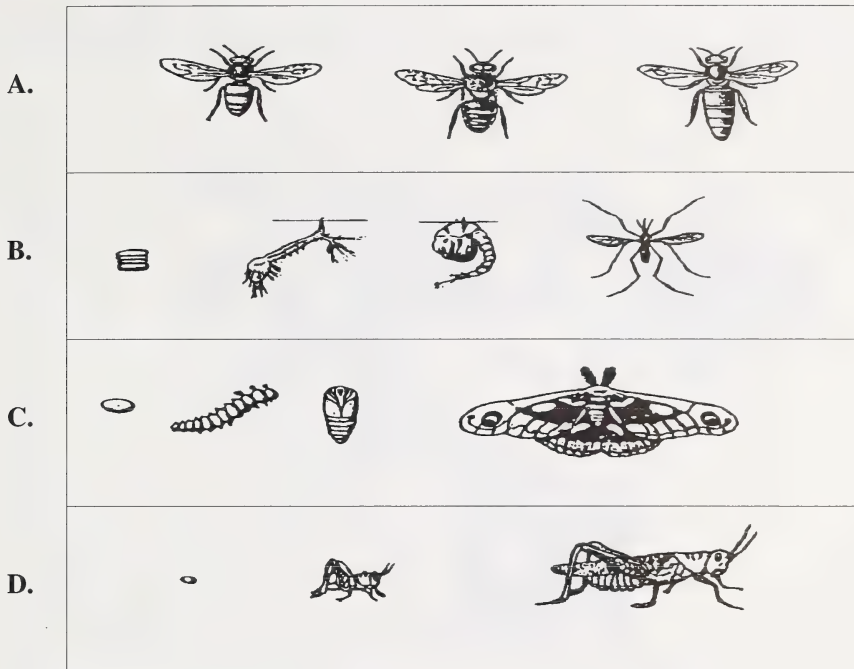
*Use the following information to answer questions 10 to 13.*

Over the past 20 years, the farmer kept careful records of different insect populations on his farm. His findings and observations are as follows:

- Many insect species exhibit several distinct adult forms within the same species (polymorphism). The farmer noted that each form has adapted for a particular function.
- From 1976 to 1989, the farmer found that he needed to use a higher concentration of insecticide each year to control the grasshopper population.
- In 1987, the farmer discovered aphids in his clover crop. Aphids are tiny insects that use the juices from plants for food. Frequently, aphids can cause a reduction in plant growth.

10. Which insect identification book would give the farmer the **most** precise and detailed identification?
- A. Insect Orders
  - B. Insect Phyla
  - C. Insect Classes
  - D. Insect Families
11. The **most** probable reason that the farmer needed to use a higher concentration of insecticide each year from 1976 to 1989 is that the insects
- A. that survived previous applications passed their resistance on to their offspring
  - B. were not affected by the insecticide because it was absorbed into the soil, water, and air
  - C. reproduced quickly enough to replace those killed by the insecticide
  - D. increased in size and weight

12. Which insect exhibits polymorphism?



13. The farmer needs to control the aphids. The **most** environmentally sound **action** he could take is to

- A. purchase insect-eating ladybugs and release them on the crop
- B. apply an insecticide and harvest the crop as quickly as possible
- C. apply a herbicide and then plough the crop under and plant again
- D. leave the aphids alone because they have a very short life span

14. The farmer planted a new high-yield hybrid corn that was being developed in southern Alberta. The original parent plants were resistant to a particular mold. However, the new corn contracted this mold and it nearly destroyed all the new plants. This is one of the problems that may occur with

- A. variation
- B. adaptation
- C. natural selection
- D. selective breeding





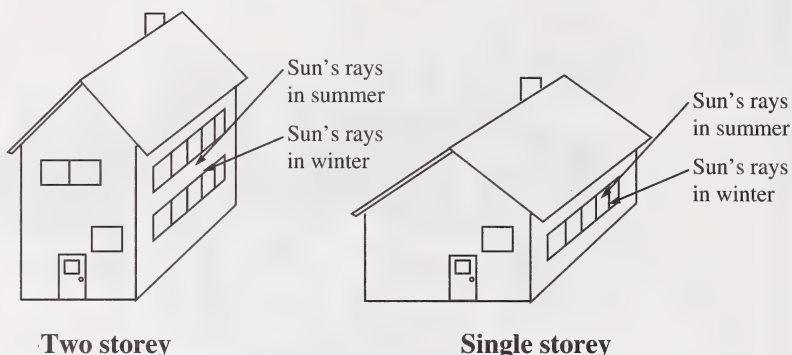
## NEW HOUSE



The Brown family moved to the city from a small town. They wanted to buy an older house that was well built, with no major defects. The children especially wanted a swimming pool. Most important, the family wanted the house to be as energy efficient as possible. The next five questions are about their experiences.

Use the following information to answer question 15.

The arrows show the angle of the sun's rays at noon during summer and winter.



Both houses are constructed of the same material and in the same way.

15. The Brown family is concerned about heat loss and cooling. They looked at the two houses shown in this diagram. Which of the following statements is correct?
- A. The single-storey house would be cooler in summer.
  - B. The two-storey house would be cooler in summer.
  - C. Both houses would be equally cool in summer because both have the same roof slope.
  - D. Both houses would overheat in summer because both have large south-facing windows.
- 
16. The Browns purchased a home and now want to install a solar collector to heat the swimming pool. The energy conversion that takes place when the sun warms the solar collector is
- A. thermal to solar
  - B. solar to thermal
  - C. solar to chemical
  - D. physical to solar



17. As she is leaving the house on a cold day, Mrs. Brown finds that the door knob on the outside door is much cooler than the surface of the door. This is because the insulation in the door
- A. stores heat for future use
  - B. is a poor conductor of heat
  - C. increases the door's heat loss
  - D. reflects heat away from the door

*Use the following information to answer question 18.*

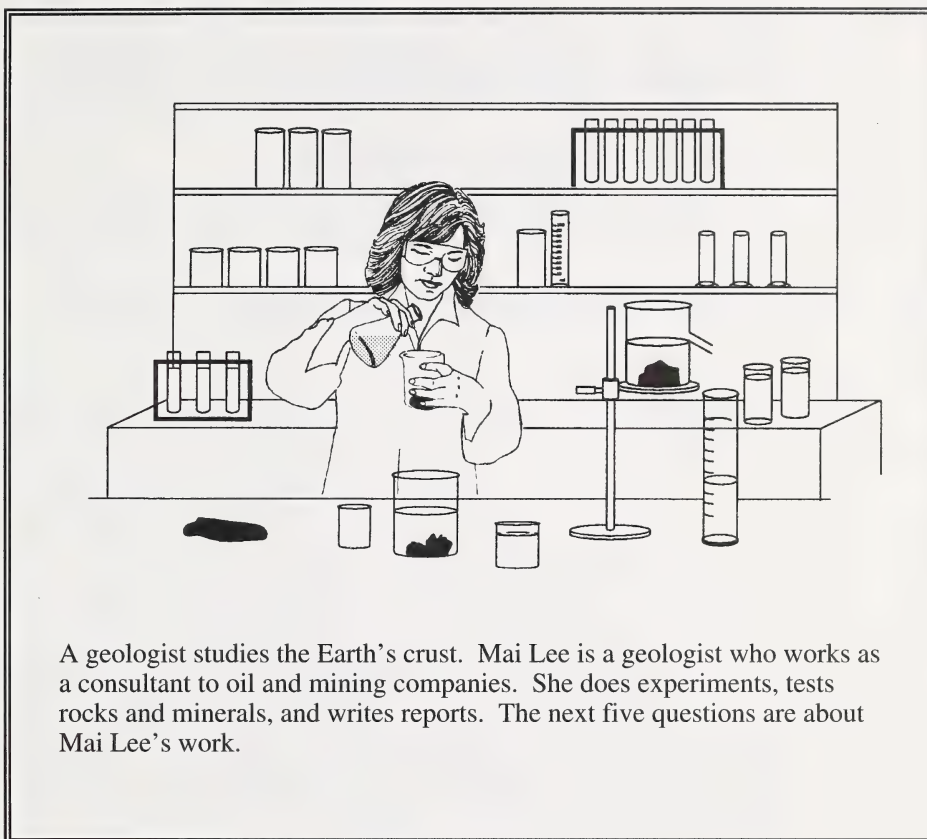
Mr. and Mrs. Brown decide to use curtain material that will make the house more energy efficient. They experiment to determine the best solar energy-absorbing material. They note the following variables:

- I. time of day
- II. type of material
- III. length of time in the sunlight
- IV. surface area exposed to sunlight

18. The variables that should be kept **constant** in this experiment are
- A. I and II
  - B. II and IV
  - C. I, III, and IV
  - D. II, III, and IV
- 
19. Mrs. Brown installs a thermocouple as a safety device on the natural gas furnace. The thermocouple converts
- A. electric current into light energy
  - B. light energy into electric current
  - C. heat energy into electric current
  - D. light energy into heat energy



## GEOLOGIST



A geologist studies the Earth's crust. Mai Lee is a geologist who works as a consultant to oil and mining companies. She does experiments, tests rocks and minerals, and writes reports. The next five questions are about Mai Lee's work.

*Use the following information to answer question 20.*

In a lab, Mai Lee made observations and wrote the following statements:

- I. Copper turns green when oxidized.
- II. Under normal atmospheric pressure, water changes from a liquid to a gas at  $100^{\circ}\text{C}$ .
- III. A 19.3 g mass of gold occupies  $1\text{ cm}^3$ .
- IV. Sulphur and iron filings are easily separated by a magnet.
- V. Sulphur and zinc powder produce an odor and a flame when heated.

**20.** Which of these statements describe(s) a chemical change?

- A. I only
- B. I and V only
- C. I, II, and III
- D. I, IV, and V

*Use the following information to answer question 21.*

Mai Lee tested the reaction rates of two pieces of limestone of equal mass. Using a mortar and pestle, she ground one piece into a fine powder and then placed it in a test tube containing 5 mL of 10% solution of hydrochloric acid. She placed the solid piece of limestone in another test tube containing an equal amount of 10% hydrochloric acid. Reactions (indicated by a bubbling action) occurred in each test tube.

**21.** Which statement about these reactions is true?

- A. The solid limestone reacted slower because it was exposed to more acid.
- B. The powdered limestone reacted more vigorously because a greater surface area was exposed to the acid.
- C. The solid limestone reacted more vigorously because a greater surface area was exposed to the acid.
- D. The powdered limestone reacted slower because it took longer for all the fine particles to react with the acid.



Use the following information to answer question 22.

Mai Lee wants to determine the reaction time for zinc and dilute hydrochloric acid. Into each of four test tubes, she places 15 mL of water and a 3 cm piece of zinc ribbon. Then she adds the following amounts of acid:

Test tube W - 2 drops  
 Test tube X - 4 drops  
 Test tube Y - 8 drops  
 Test tube Z - 20 drops

Mai Lee starts a stop watch when the acid is added and stops the watch when the contents of each test tube stop bubbling.

22. Which table would be the **best** to use to record the results of this experiment?

A.

Drops of Acid Used	Length of Zinc Ribbon (cm)	Reaction Time (s)
2		
4		
8		
20		

B.

Test Tube	Drops of Acid Used	Reaction Time (s)
W		
X		
Y		
Z		

C.

Test Tube	Water Used (mL)	Length of Zinc Ribbon (cm)	Drops of Acid Used
W			
X			
Y			
Z			

D.

Test Tube	Water Used (mL)	Length of Zinc Ribbon (cm)	Reaction Time (s)
W			
X			
Y			
Z			

Use the following information to answer question 23.

During a school visit, Mai Lee demonstrates a common test involving four household substances. Using red litmus paper and blue litmus paper, she shows students how to determine which substances are acids and which are bases. She makes a solution of each substance and then tests it with the litmus paper.

**Results of Acid/Base Test**

Solution	Red Litmus	Blue Litmus
Orange juice	Red	Red
Baking soda	Blue	Blue
Drain cleaner	Blue	Blue
Italian salad dressing	Red	Red

23. The substances that contain acid are
- A. orange juice and baking soda
  - B. baking soda and drain cleaner
  - C. baking soda and Italian salad dressing
  - D. orange juice and Italian salad dressing

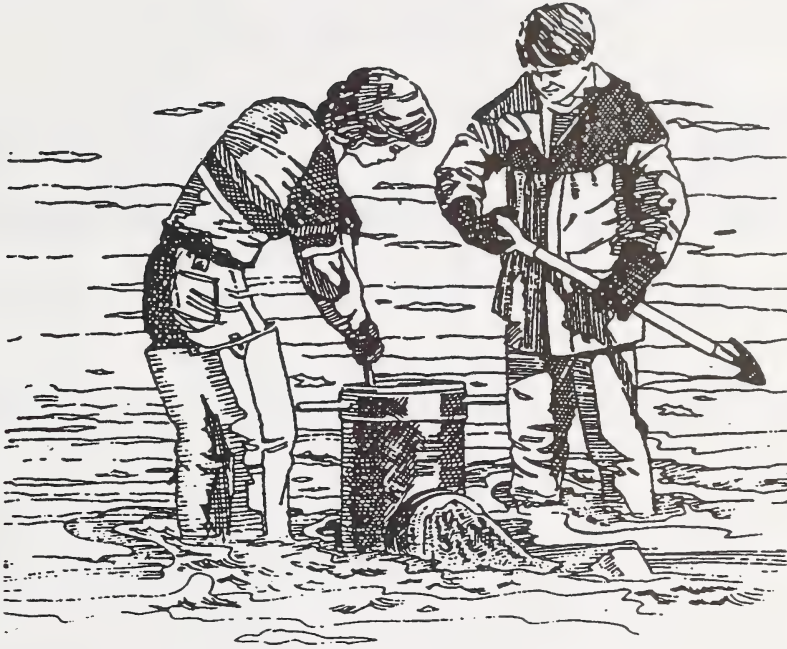
Use the following information to answer question 24.

The following materials are placed in three groups:

- Lead and iron - Group 1
- Water and alcohol - Group 2
- Coal and shale - Group 3

24. Which physical property **best** distinguishes the materials in each group?
- A. Shape
  - B. Color
  - C. Volume
  - D. Density

## WATER QUALITY



A group of students are working on a summer research project concerning the quality of river water. The next seven questions are about some of the problems that the students investigated.

Use the following information to answer questions 25 to 27.

The students studied the population of a specific organism found in a section of a river on the outskirts of Edmonton.

**Data Taken from Several River Water Samples**

<b>Sample Number (location)</b>	<b>Volume of Sample (L)</b>	<b>Amount Analysed (drops)</b>	<b>Average Population of a Specific Organism (per drop)</b>	<b>Temperature of Water Sample (°C)</b>
I	3	5	18	12
II	3	10	4	10
III	3	10	7	11
IV	4	10	23	14

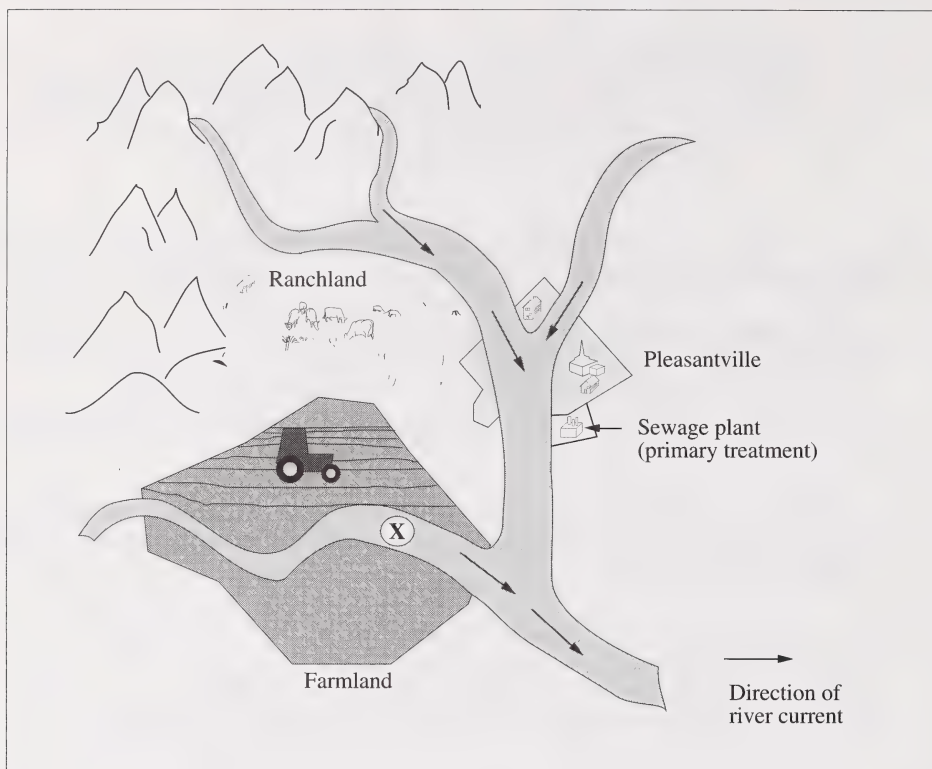
Note: The eye dropper used yields an average of 20 drops per mL.

25. A feature of this experiment that is scientifically sound is that the
- A. responding (dependent) variables remained constant
  - B. manipulated (independent) variables remained constant
  - C. average population of a specific organism per drop of sample was studied
  - D. sample volume taken from each location along the river was the same
26. What is the average population of the specific organism (per drop) in this section of the river?
- A. 13
  - B. 17
  - C. 52
  - D. 70



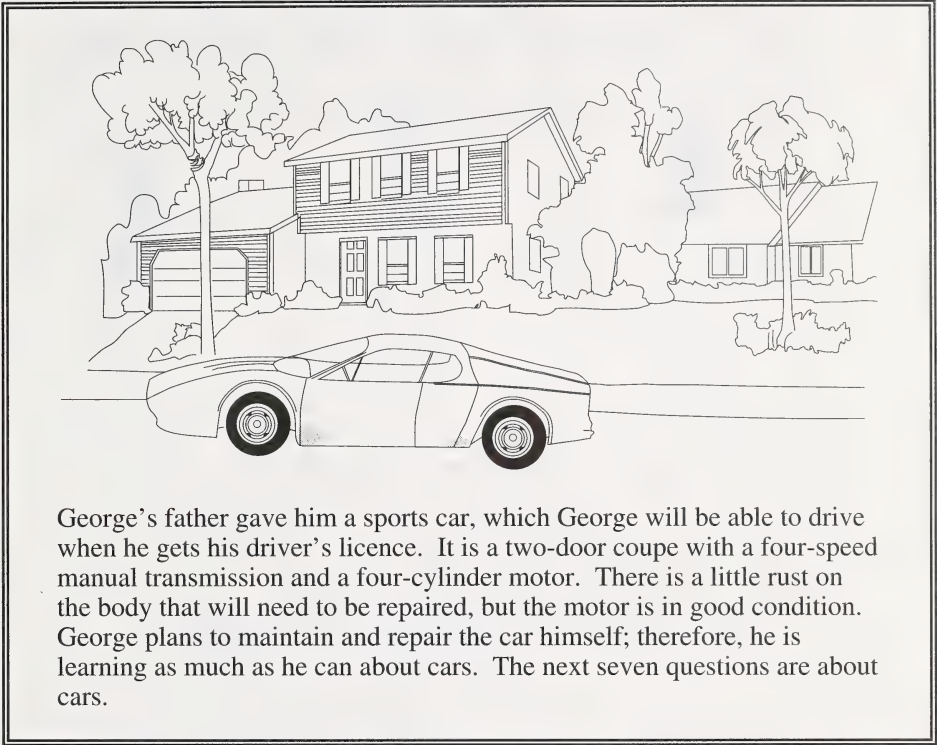
27. The average population of the specific organism in this section of the river is
- A. not related to the amount of water analyzed
  - B. decreasing with increasing temperatures
  - C. greater with a larger water sample size and a larger number of samples
  - D. greater with a smaller water sample size and a smaller number of samples
- 
28. The students determine that the river has a low concentration of dissolved oxygen. This is **most likely** caused by
- A. a small population of fish using up the oxygen
  - B. river water being too cold to absorb oxygen from the air
  - C. river water being too turbulent, allowing the oxygen to escape
  - D. decomposers breaking down biological wastes and using up the oxygen
29. An investigation reveals a possible relationship between liquid industrial wastes and the growth rate of fish in a northern river. To confirm this hypothesis, the students should measure the
- A. effects of air pollution on spawning
  - B. rate of fish growth per gram of food
  - C. growth of fish under controlled conditions of pollution
  - D. development of fish embryos at various stages of growth
30. The students were approached by an automobile tire company that wanted to dispose of used tires by recycling them. An example of **recycling** used tires is
- A. collecting and storing tires in a field
  - B. reducing and compacting tires for landfill
  - C. breaking tires down and rebuilding them into other products
  - D. burning tires in large incinerators to produce thermal and electrical energy

Use the following information to answer question 31.



31. The water sample taken at **X** shows high levels of phosphate and nitrate. The **most likely** reason is that
- A. phosphate and nitrate build up whenever large numbers of farm animals are raised together
  - B. soil around this branch of the river is naturally high in these compounds
  - C. the farmers who till the farmland use excess commercial fertilizer
  - D. the farmers use large quantities of detergents when cleaning farm equipment

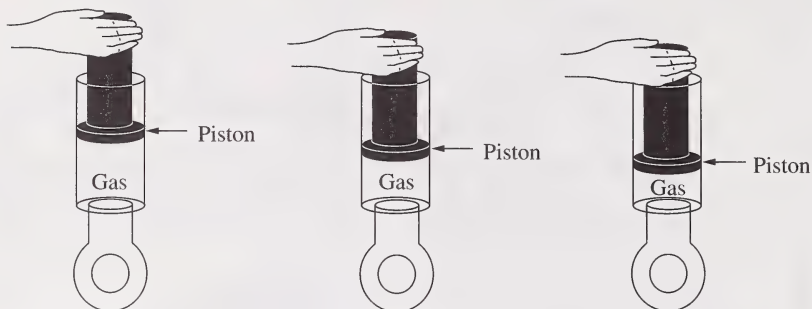
## SPORTS CAR



George's father gave him a sports car, which George will be able to drive when he gets his driver's licence. It is a two-door coupe with a four-speed manual transmission and a four-cylinder motor. There is a little rust on the body that will need to be repaired, but the motor is in good condition. George plans to maintain and repair the car himself; therefore, he is learning as much as he can about cars. The next seven questions are about cars.

Use the following information to answer question 32.

George is testing a gas-filled shock absorber by pushing down on the piston. As the piston goes down, the volume of the gas decreases.

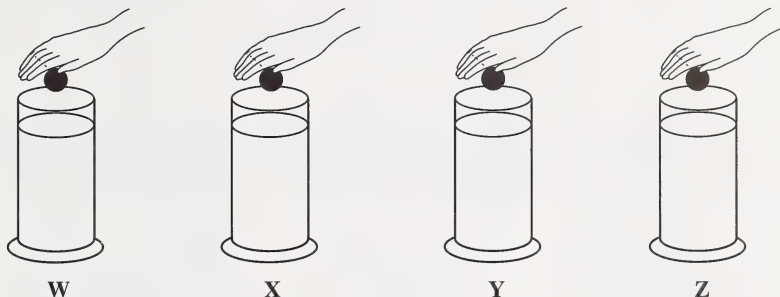


32. This observation supports the correct inference that
- A. gas particles can decrease in size
  - B. space exists between gas particles
  - C. gas temperature increases as pressure increases
  - D. gas particles move faster as pressure increases
- 
33. George would like to stop the rusting on the body of his car. A simple way to prevent further rusting would be to
- A. add acid to the rusting area
  - B. use steel wool to remove the rust
  - C. use soap and water to wash the rust off
  - D. seal the treated area of rust with an airtight substance



Use the following information to answer questions 34 and 35.

George finds different grades of oil in the garage. To test the oil, he fills each of four 100 mL cylinders with a different grade of oil. The temperature of the oil in each cylinder is  $20^{\circ}\text{C}$ . He drops a marble into each cylinder and times how long it takes for each marble to reach the bottom of the cylinder. He finds that the higher the SAE number, the more viscous the oil.



The table summarizes his data.

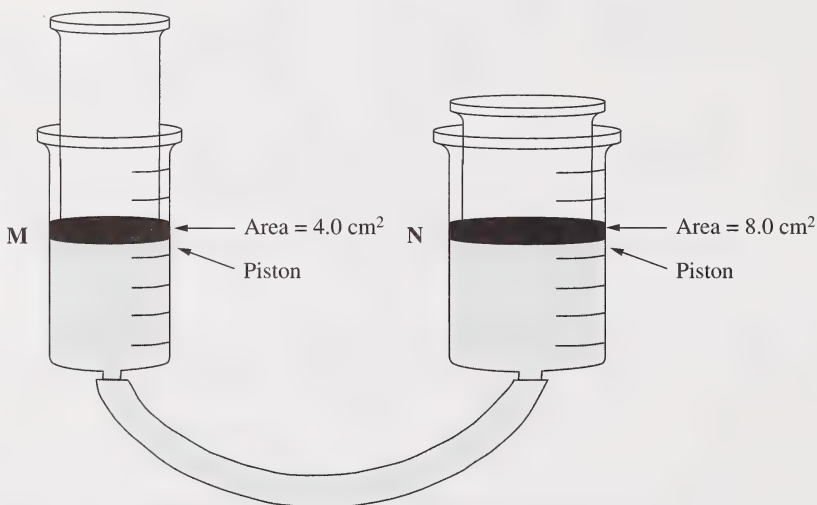
Cylinder	Grade of Oil	Time (seconds)
W	SAE 40	2.4
X	SAE 20	1.8
Y	SAE 10	0.9
Z	SAE 30	1.9

34. The grade of oil that is **most** suitable for a car being driven for a long period of time in very hot weather is
- A. SAE 10
  - B. SAE 20
  - C. SAE 30
  - D. SAE 40

35. If the oil in each cylinder is cooled to  $10^{\circ}\text{C}$ , the time it takes the marble to reach the bottom of the cylinder would
- A. decrease in all cylinders
  - B. increase in all cylinders
  - C. remain the same
  - D. increase in cylinder Y only
- 

*Use the following information to answer question 36.*

To learn how fluid pressure affects the car's brake system, George makes a model. He joins two syringes as shown in the diagram. The surface area of the large piston is twice the surface area of the small piston.

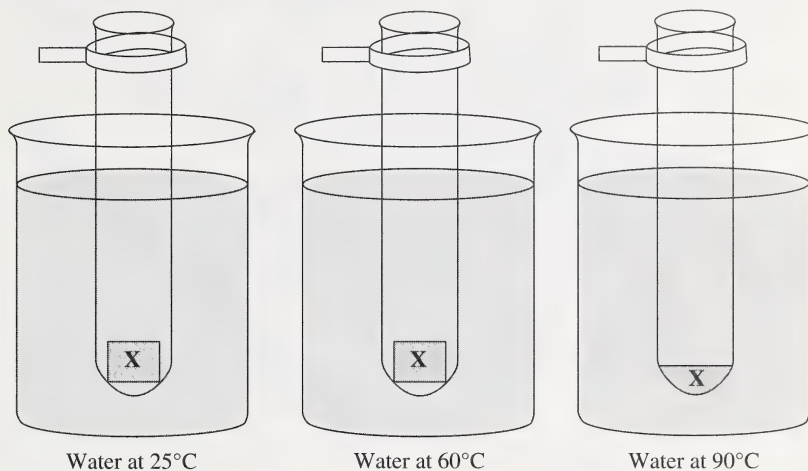


36. If the system is full of fluid and the piston in syringe **M** is pushed down 1.0 cm, the piston in syringe **N** will go up
- A. 0.5 cm
  - B. 1.0 cm
  - C. 1.5 cm
  - D. 2.0 cm

Use the following information to answer question 37.

George plans to use a paste wax to protect the paint on his car. He designs an experiment to test for the melting point of the wax.

**X** represents a sample of the same wax in each test tube.



37. The melting point of the wax is

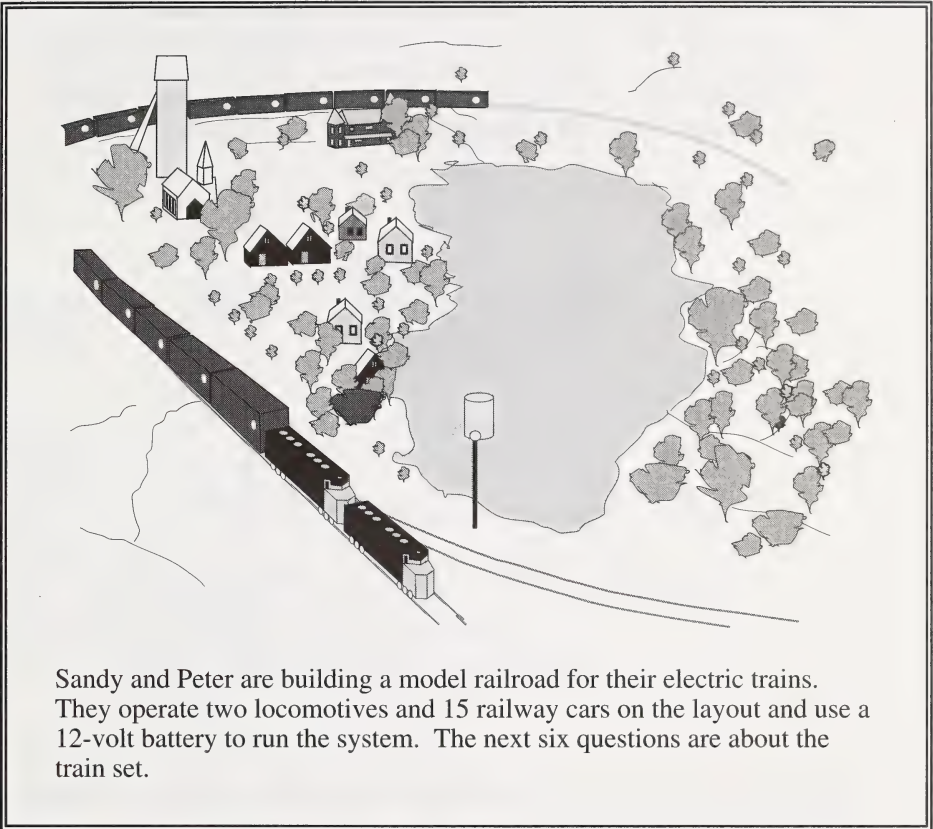
- A. lower than 25°C
- B. between 25°C and 60°C
- C. between 60°C and 90°C
- D. higher than 90°C

38. George uses glue to repair the door on the car's tape player. To prepare the glue, he mixes two liquids and notices an increase in their temperature. This increase in temperature is **most likely** caused by the

- A. friction of mixing liquids
- B. liquids absorbing heat from the room
- C. heat flowing from the plastic door into the liquids
- D. heat released from a chemical reaction between the liquids



## ELECTRIC TRAIN SET

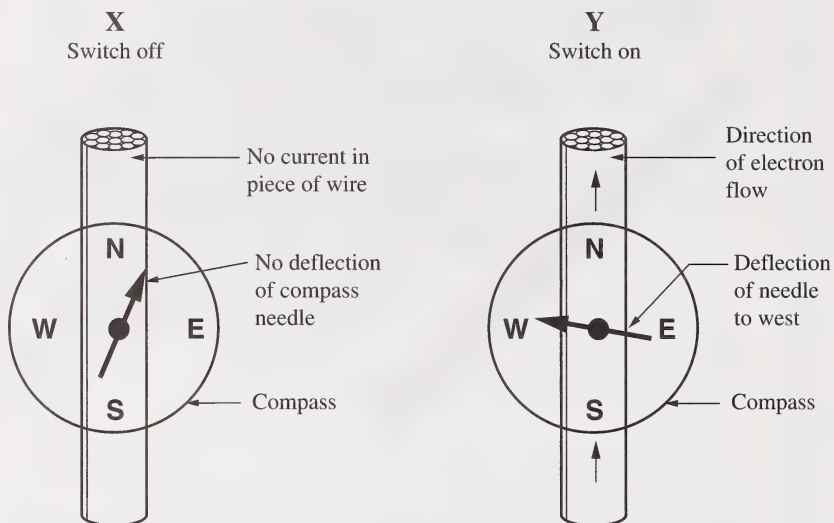


Sandy and Peter are building a model railroad for their electric trains. They operate two locomotives and 15 railway cars on the layout and use a 12-volt battery to run the system. The next six questions are about the train set.



Use the following information to answer question 39.

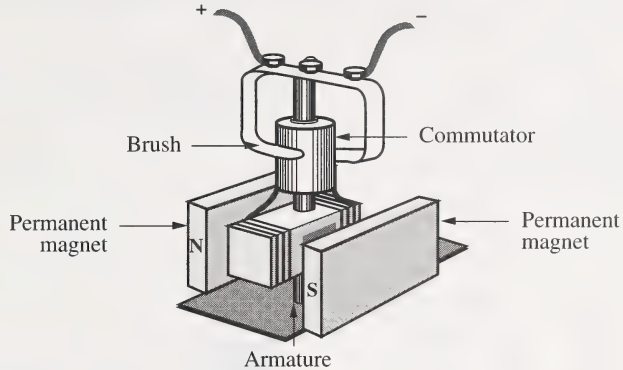
To test whether a wire is carrying an electric current, Sandy places a plastic compass on top of the wire. With the switch off, the compass needle is in the position shown in diagram X. When Sandy turns the switch on, the wire carries an electric current and the needle suddenly moves to one side. This observation is shown in diagram Y.



39. If the electric current travels in the opposite direction to that shown in diagram Y, the compass needle will point
- A. east
  - B. west
  - C. north
  - D. south

Use the following information to answer question 40.

Both locomotives are driven by an electric motor.

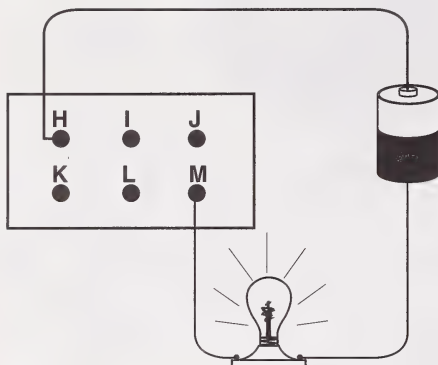


40. Which action would **not** increase the speed of the electric motor?
- A. Using stronger magnets
  - B. Using a greater electric current
  - C. Increasing the number of coils of wire
  - D. Reversing the direction of the permanent magnets

Use the following information to answer question 41.

Sandy finds an old rail switching circuit board that does not have a circuit diagram. When she tests this circuit board using a dry cell and bulb, she obtains the following results:

Contacts Tested	HI	HJ	HK	HL	HM	IJ	IK	IL	JK	KM	LM
Response of Bulb	+	—	+	—	+	—	+	—	—	+	—



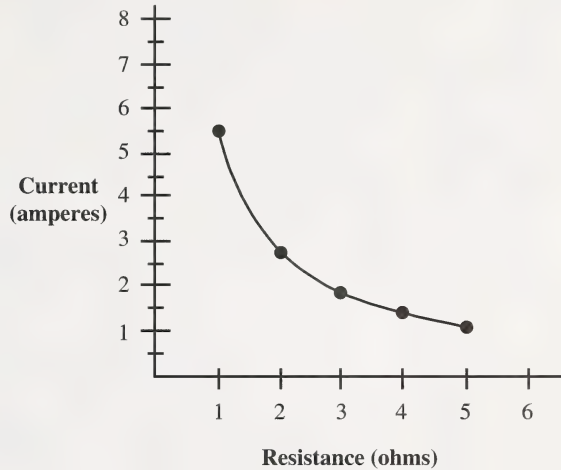
+ Bulb lights  
— Bulb does not light

41. The bulb will also light for connection

- A. JM
- B. JL
- C. IM
- D. KL

Use the following information to answer question 42.

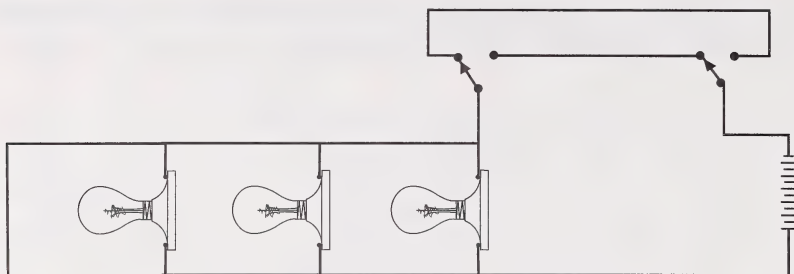
Peter uses a multi-meter to test the current and resistance of a variable resistor and plots the results on the graph.



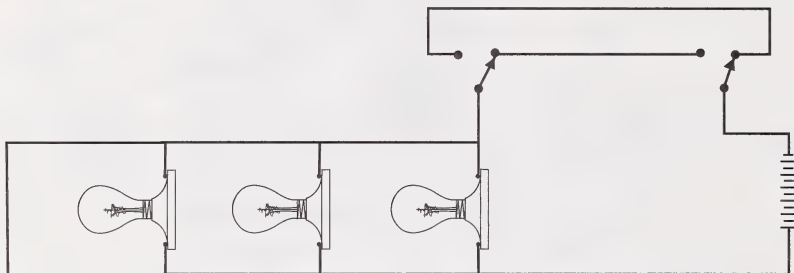
42. The graph shows that current
- A. increases when resistance decreases
  - B. decreases when resistance decreases
  - C. increases when resistance increases
  - D. doubles when resistance increases

43. Peter designs a new circuit for a light system in the model train station. Which diagram shows a circuit in which all three bulbs will light up?

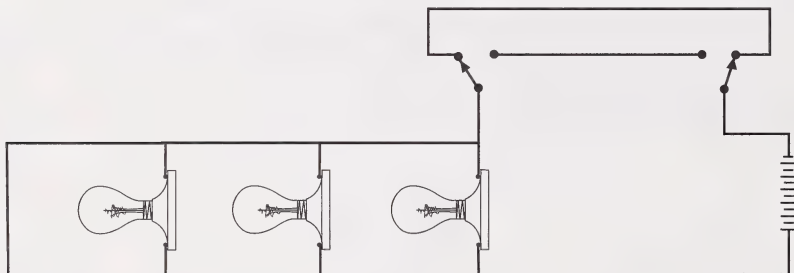
A.



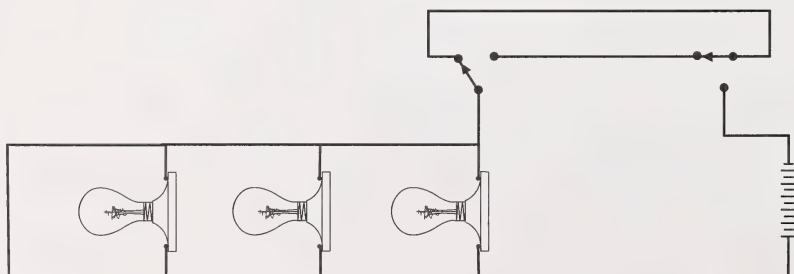
B.



C.



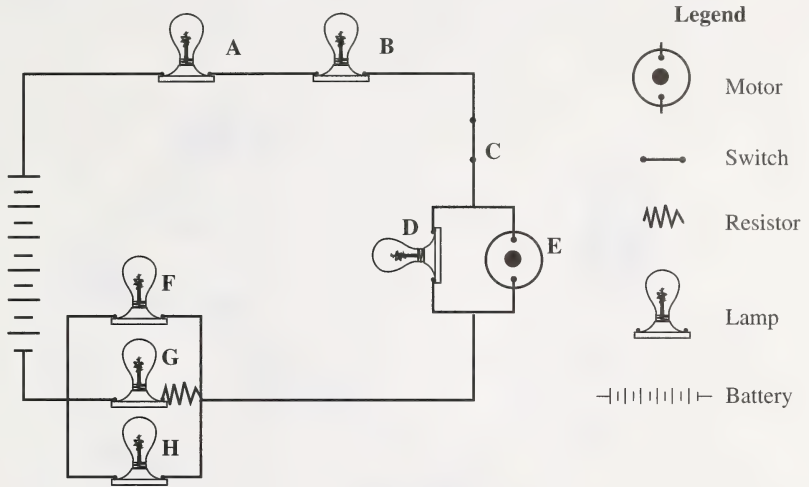
D.





Use the following information to answer question 44.

The following diagram shows the circuit for the model farm shed.

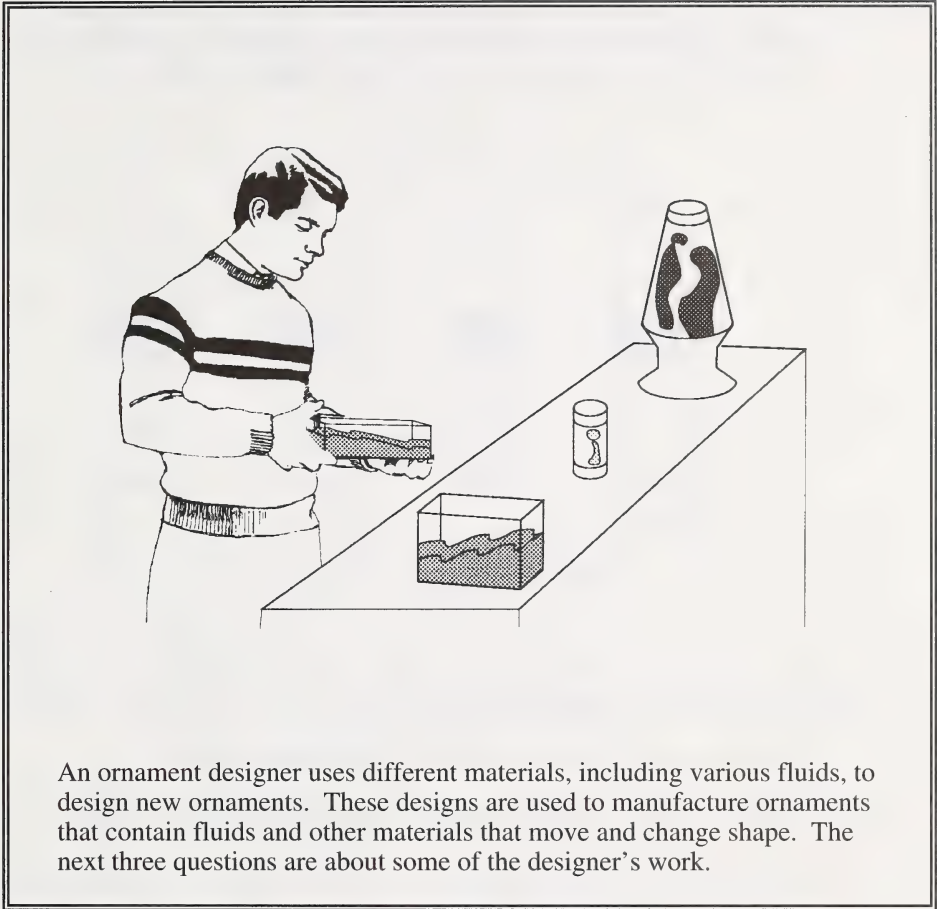


44. What will be the result if bulb B is removed from its socket?

- A. All other devices will stop working.
- B. All other devices will continue to work.
- C. Only devices D, E, F, G, and H will stop working.
- D. Only devices D, E, F, G, and H will continue working.



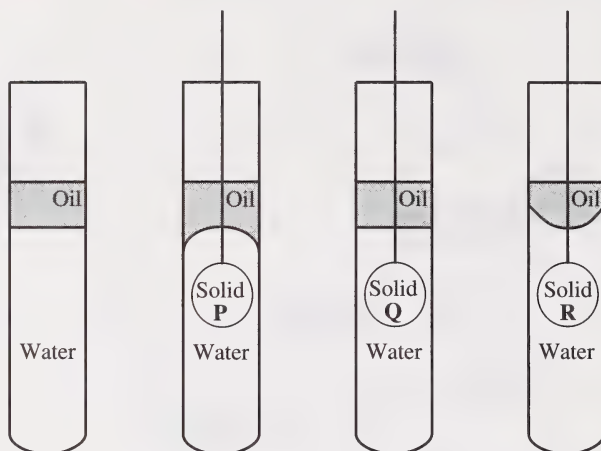
## ORNAMENT DESIGNER



An ornament designer uses different materials, including various fluids, to design new ornaments. These designs are used to manufacture ornaments that contain fluids and other materials that move and change shape. The next three questions are about some of the designer's work.

Use the following information to answer question 45.

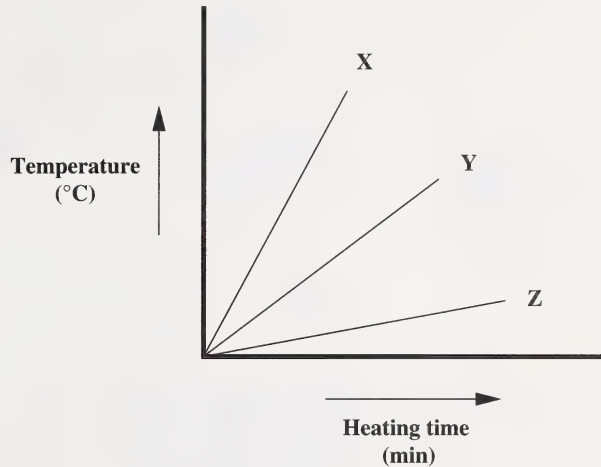
In one experiment, the designer tests how solids at different temperatures affect liquids. In calm liquids, he suspends three solids made of the same material. The results are represented in the diagrams below.



45. Which statement **best** explains the results?
- A. Solid R is releasing heat and solid Q is not releasing heat.
  - B. Solid P is colder than the water and solid R is hotter than the water.
  - C. Solid Q is at the same temperature as the water, solid P is releasing heat, and solid R is absorbing heat.
  - D. Solid Q is at the same temperature as the water, but the relative temperatures of solid P and solid R cannot be inferred.

Use the following information to answer question 46.

The designer heats three different masses of a newly developed fluid. He records the temperature and heating time for each sample and plots the results on the following graph:



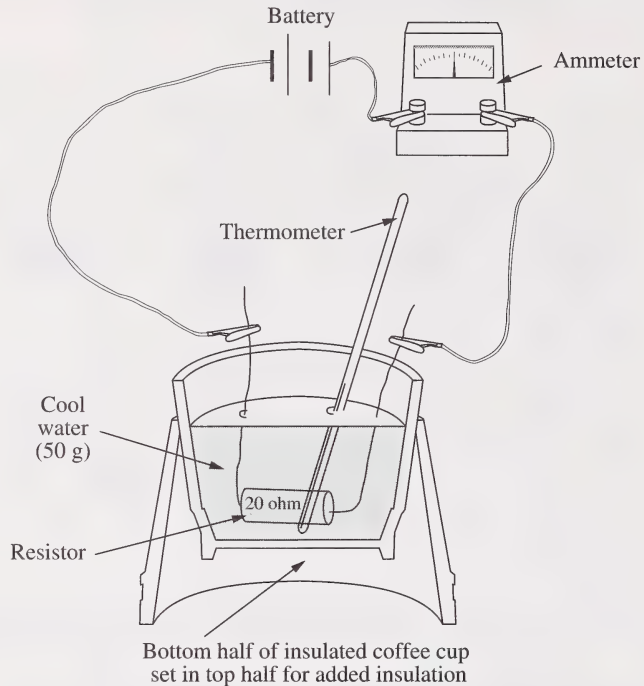
46. He infers that the rate of temperature change depends upon the

- A. source of heat
- B. mass of the substance
- C. density of the substance
- D. temperature of the substance



Use the following information to answer question 47.

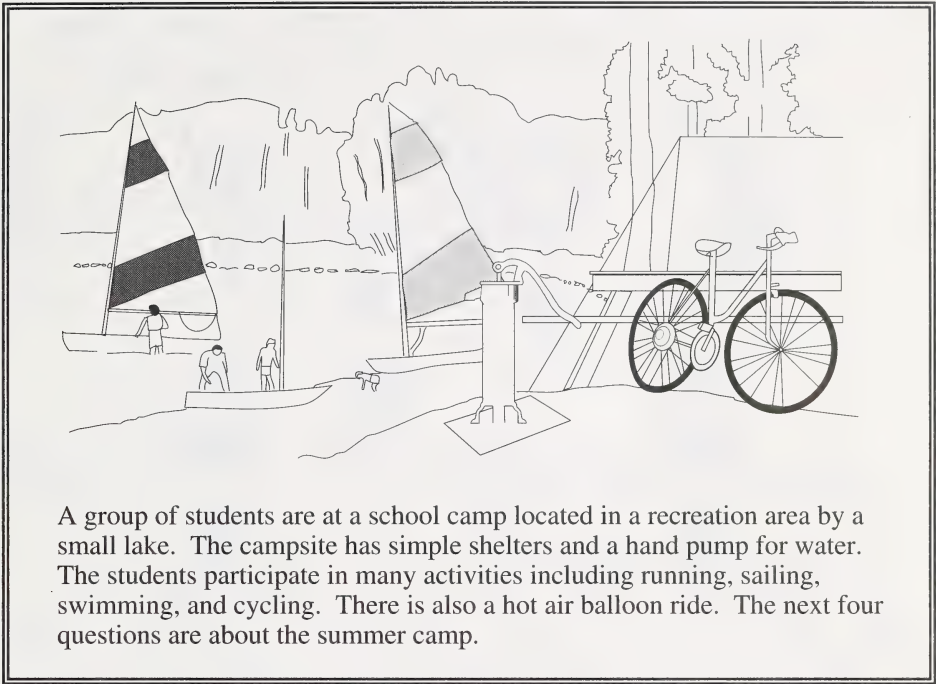
The designer tests the effect of a resistor in water. He connects a 20-ohm resistor to a circuit, as pictured below.



47. Which statement describes what will occur in this experiment?

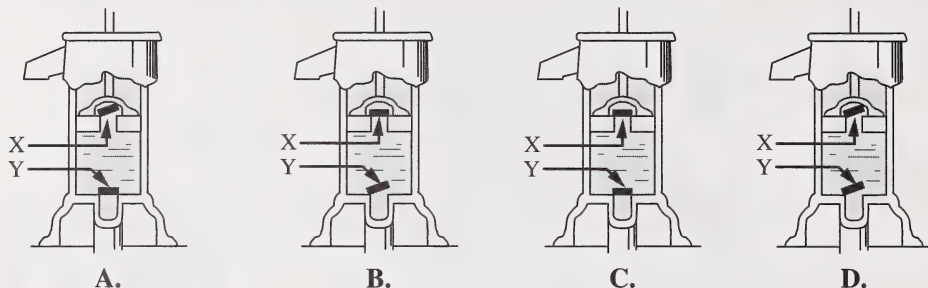
- A. The water temperature will stay the same.
- B. The water temperature will rise.
- C. The ammeter will burn out.
- D. The resistor will glow.

## SUMMER CAMP



A group of students are at a school camp located in a recreation area by a small lake. The campsite has simple shelters and a hand pump for water. The students participate in many activities including running, sailing, swimming, and cycling. There is also a hot air balloon ride. The next four questions are about the summer camp.

48. After making some drawings, Rhonda is able to find out how the hand pump works. Which cross-section of a pump shows the correct position of the valves **X** and **Y** when the piston is moving up?



49. In which sport is the resistance of fluid to forward movement the **most** significant problem?
- A. Running
  - B. Sailing
  - C. Swimming
  - D. Bicycling

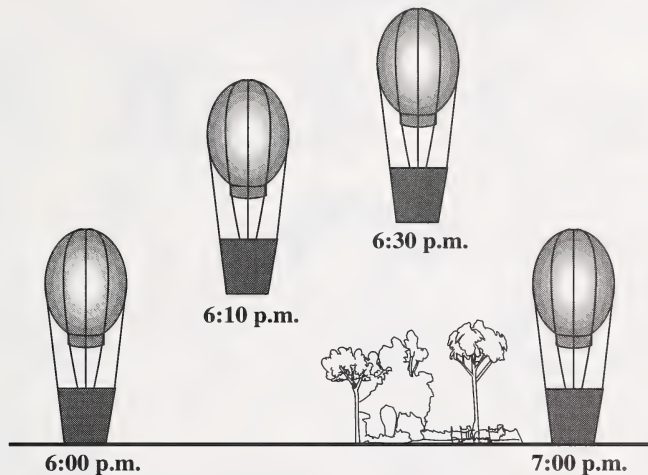
*Use the following information to answer question 50.*

Jill uses hot rocks to heat water for washing dishes. She takes two equally heated rocks from the fire and places one in one container and the other in an identical container. Each container holds 4 L of water at the same temperature.

50. The final temperature of the water in each container will always be the same if the two rocks have equal
- A. mass and are the same substance
  - B. mass and are a different substance
  - C. volume and are a different substance
  - D. volume and a different initial temperature

Use the following information to answer question 51.

Sid and Tanya take a hot air balloon ride. They begin their trip at 6:00 p.m. At 6:30 p.m., they reach their highest altitude. The trip is over at 7:00 p.m., when they land.

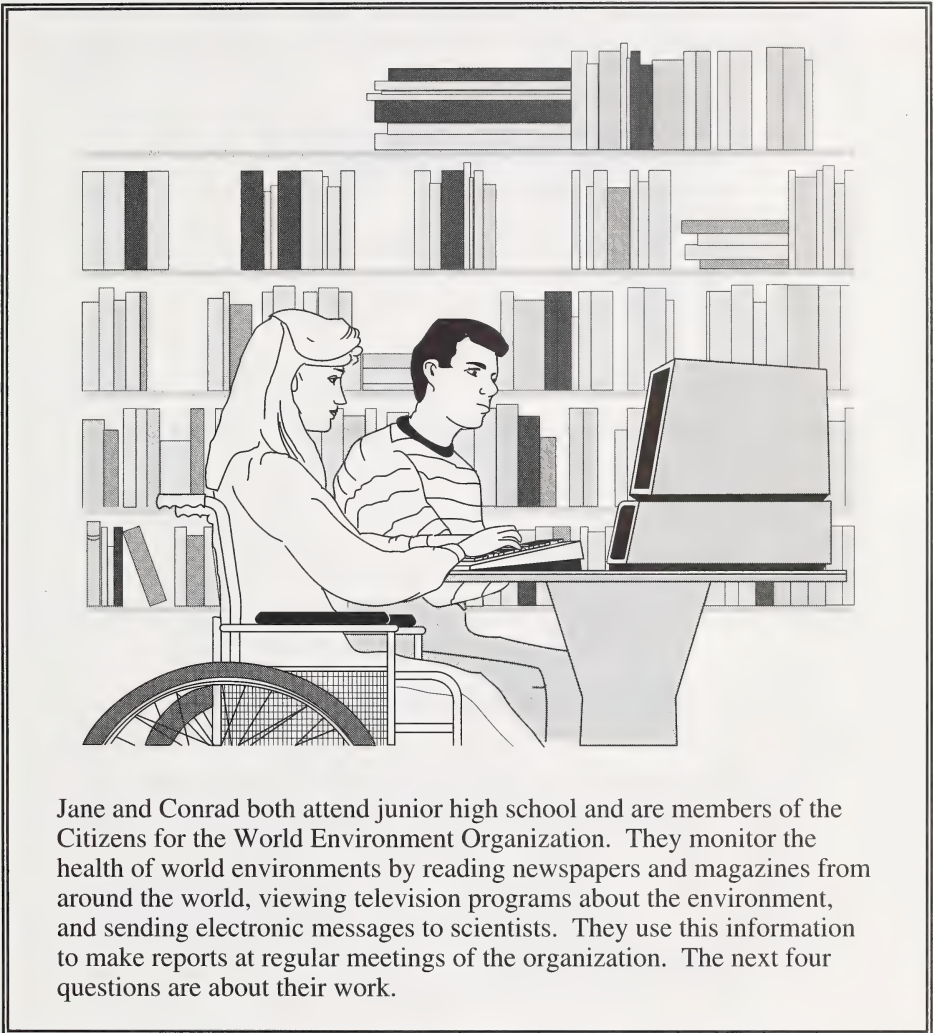


51. The buoyant force on the balloon is less than the gravitational force when the balloon is
- A. rising from the ground
  - B. descending to the ground
  - C. filled to its maximum capacity
  - D. floating in the air at 6:30 p.m.





## WORLD ENVIRONMENT ORGANIZATION



Jane and Conrad both attend junior high school and are members of the Citizens for the World Environment Organization. They monitor the health of world environments by reading newspapers and magazines from around the world, viewing television programs about the environment, and sending electronic messages to scientists. They use this information to make reports at regular meetings of the organization. The next four questions are about their work.

*Use the following information to answer question 52.*

Jane read about a recently discovered organism that has the following characteristics:

- it is cold blooded
- it has lungs
- it has smooth, moist, purple and pink skin
- it has a well-defined head
- it has four short legs
- it moves with a hopping motion
- it eats fruit
- it has an internal skeleton

52. In what type of habitat would this organism **most** likely be found?

- A. A hot, dry, desert
- B. A dry, grassy, prairie
- C. A warm, humid, rainforest
- D. A cool, boreal, mixed forest

*Use the following information to answer question 53.*

Jane reports to the group. She tells them that acid rain occurs when products of combustion of fossil fuels are released into the atmosphere, combine with moisture, and fall to the earth as acid rain or snow. The high acidity damages both water environments and human-made structures. In an effort to combat the effects of acid rain, governments have begun dumping large quantities of calcium carbonate (limestone) into lakes to reduce their acidity.

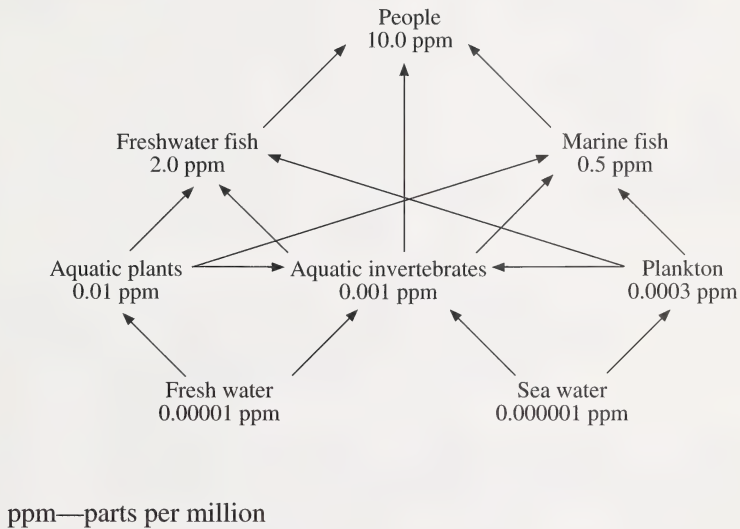
53. For an environmentalist, which would be the **most** environmentally friendly means of dealing with the problem of acid rain?

- A. Reducing the acidity with a base
- B. Putting acid-tolerant fish into the lakes
- C. Adding calcium carbonate (limestone) to the lakes
- D. Reducing the amount of sulphur oxides released into the atmosphere

Use the following information to answer question 54.

After doing research on the levels of a persistent industrial pollutant in different food chains, Conrad makes the following chart showing a food pyramid.

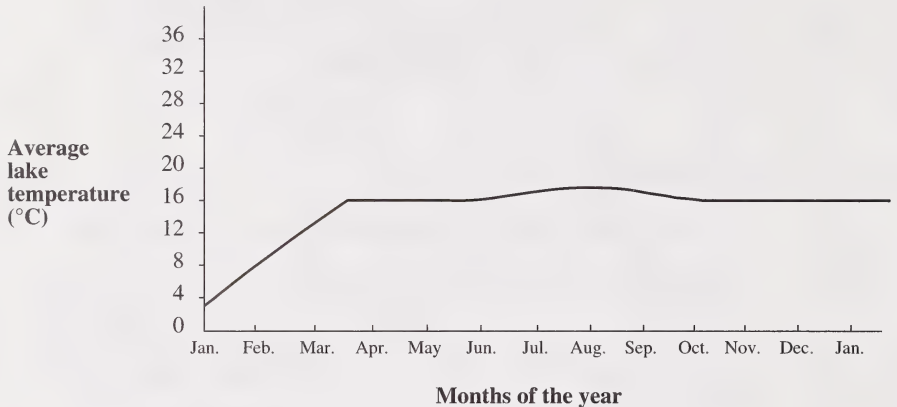
**Chart Showing the Concentration of a Persistent Industrial Pollutant**



54. The chart shows that the concentration of this industrial pollutant
- A. is higher in sea water than it is in fresh water
  - B. increases with each upward step in the food pyramid
  - C. decreases with each upward step in the food pyramid
  - D. is lower in sea water invertebrates than it is in freshwater invertebrates

Use the following information to answer question 55.

Conrad makes notes from a television program that describes the issues and problems concerning a newly constructed thermal nuclear plant. The thermal nuclear plant draws water from a small lake to use in its cooling process. The water is returned to the lake  $11^{\circ}\text{C}$  warmer than when it was removed. The immediate impact the new plant has on the average temperature of the lake is shown in the graph.



The lake is inhabited by a species of trout, which reproduce at temperatures between  $0^{\circ}\text{C}$  and  $10^{\circ}\text{C}$ .

55. A reasonable prediction that can be made from these data is that thermal nuclear power plants
- A. cause a decline in the trout population
  - B. create large amounts of water at  $16^{\circ}\text{C}$
  - C. decrease the food available to trout
  - D. do not affect the temperature of a lake

## HOSPITAL



Doctors, nurses, and research scientists working at a university hospital use different technologies to care for their patients. They investigate different ways of producing drugs and of using technology for patient care. The next five questions are about health care.

*Use the following information to answer question 56.*

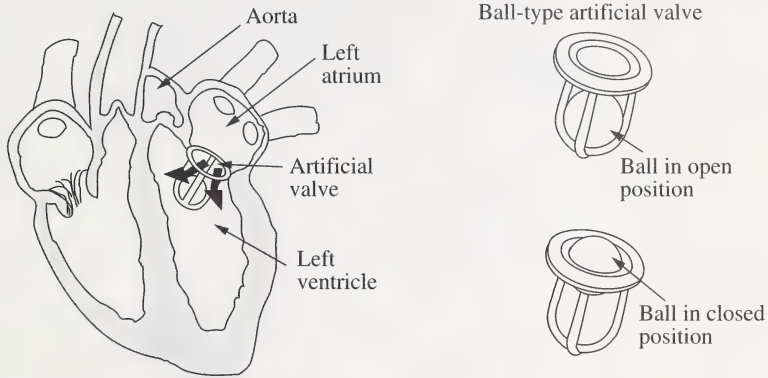
In the past, patients with diabetes were treated with insulin obtained from animals. By using genetic engineering techniques, scientists have been able to attach insulin-producing genes to bacterial DNA. These bacteria produce large amounts of scarce human hormones. Scientists predict that hormones produced by bacteria will be inexpensive and will not cause allergic reactions.

56. Scientists developed hormone-producing bacteria because they wanted to
- A. learn about bacteria
  - B. discover a cure for diabetes
  - C. find a way to increase the supply of hormones for use by humans
  - D. compare the hormones produced by bacteria with hormones produced naturally
- 
57. A laboratory technician is making a salt solution. The **best** way to increase the solubility of salt in 1 L of water is to
- A. heat the solution
  - B. add more salt
  - C. add more sugar
  - D. increase the air pressure



Use the following information to answer question 58.

During open-heart surgery, doctors often use artificial valves. If a person has a heart with a defective valve, an artificial valve can be used to replace the defective valve. This is illustrated below.

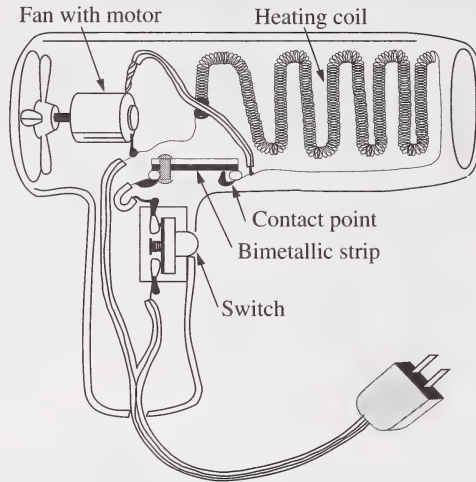


58. When the ball of the valve is in the “open” position, blood is

- A. forced out of the left ventricle into the aorta
- B. supplied by the left atrium to the left ventricle
- C. forced out of the left ventricle into the left atrium
- D. supplied by the aorta to the left ventricle

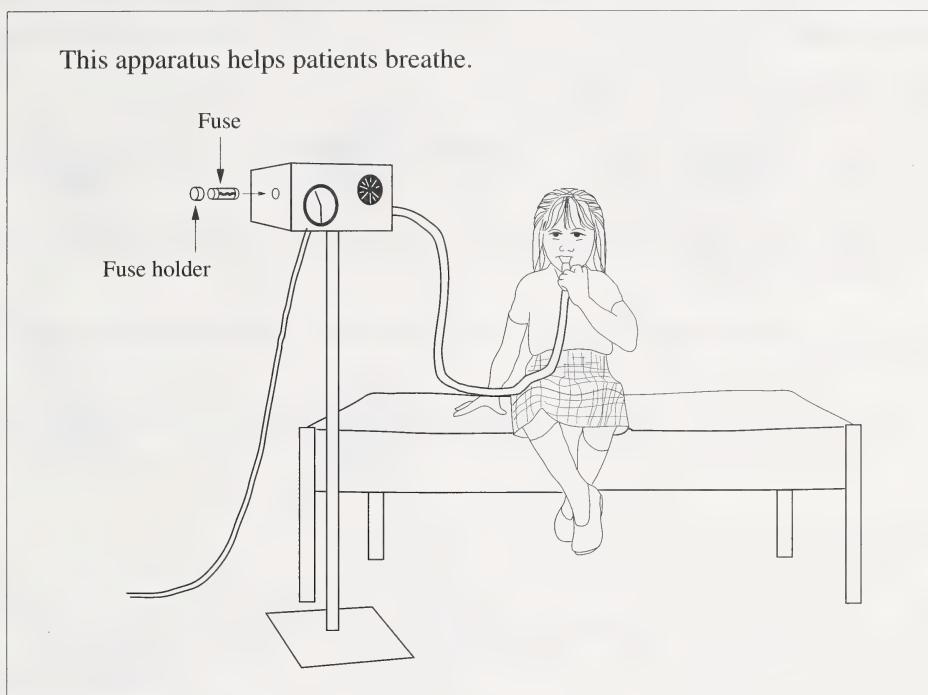
Use the following information to answer question 59.

A hospital maintenance worker dismantles a hair dryer to repair it. A drawing of a hair dryer is shown below.



59. The device in the hair dryer that automatically turns the hair dryer off if it overheats is the
- A. switch
  - B. heating coil
  - C. bimetallic strip
  - D. fan with motor

*Use the following information to answer question 60.*



**60.** Fuses are used in this apparatus in order to

- A. increase the current
- B. decrease the voltage
- C. slow the flow of electricity
- D. keep wires from overheating

***You have now completed Part A. Proceed directly to Part B.***

PART B: NUMERICAL RESPONSE

Instructions

- 1. Read each question carefully.
- 2. Record your answer on the answer sheet by writing it in the boxes and filling in a circle in **every** column.
- 3. Mark only one answer for each question. If you change an answer, **erase your first mark completely**.
- 4. Be sure that the number on the answer sheet matches the number of the question you are doing.
- 5. For each question in Part B, be sure to fill in all **four** boxes and **four** circles, as shown in these examples:

Examples

1. Following is a list of electrical appliances:

- 1. refrigerator
- 2. oven
- 3. blender
- 4. toaster

Place these appliances in alphabetical order.

Answer: \_\_\_\_\_, \_\_\_\_\_, \_\_\_\_\_, \_\_\_\_\_

Answer: 3, 2, 1, 4

3	2	1	4
<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
<input type="radio"/>	<input type="radio"/>	<input checked="" type="radio"/>	<input type="radio"/>
<input type="radio"/>	<input checked="" type="radio"/>	<input type="radio"/>	<input type="radio"/>
<input checked="" type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
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<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
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<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

2. Place the number that matches the animal on the line above its correct name.



1



2



3



4

\_\_\_\_\_, \_\_\_\_\_, \_\_\_\_\_, \_\_\_\_\_  
moose      goat      deer      sheep

Answer: 2, 4, 3, 1

2	4	3	1
0	0	0	0
1	1	1	1
2	2	2	2
3	3	3	3
4	4	4	4
5	5	5	5
6	6	6	6
7	7	7	7
8	8	8	8
9	9	9	9

3. A mechanic used a hydraulic press to compress a spring. If the hydraulic press exerts a pressure of  $50.0 \text{ N/cm}^2$  and the surface area of the spring is  $1.25 \text{ cm}^2$ , what is the force exerted on the spring?

6	2	.	5
0	0	0	0
1	1	1	1
2	2	2	2
3	3	3	3
4	4	4	4
5	5	5	5
6	6	6	6
7	7	7	7
8	8	8	8
9	9	9	9

Answer: 62.5 N (newtons)

*Start Part B immediately.*

1. An engineer designed an electric circuit to test the heating effect of different thicknesses of the same type of wire.

These variables were kept the same:

- strength of the current
- length of the wire
- period of time

The table shows the results.

Wire Number	Diameter (mm)	Temperature (°C)
4	0.4	50
3	0.2	70
2	0.3	60
1	0.1	80

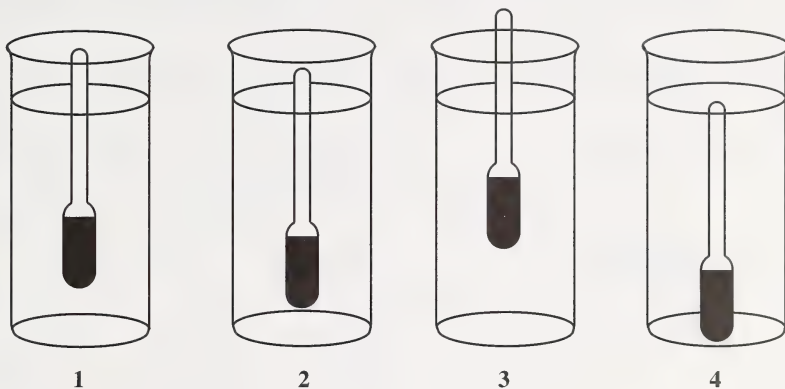
Order the wires from **lowest** to **highest** resistance.

Answer: \_\_\_\_\_, \_\_\_\_\_, \_\_\_\_\_, \_\_\_\_\_



Use the following information to answer numerical-response question 2.

A candy maker tested four different sugar solutions by placing a hydrometer in each.

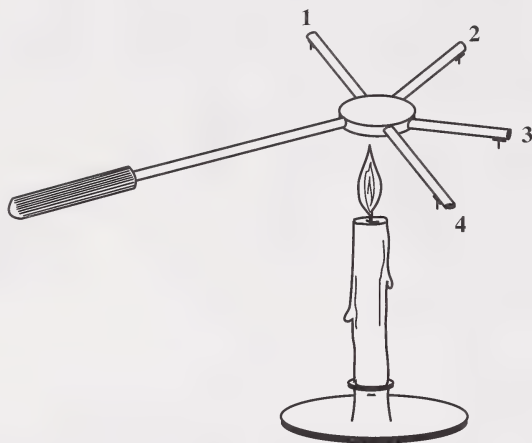


2. Arrange the four solutions in order from **lowest** density to **highest** density.

Answer: \_\_\_\_\_, \_\_\_\_\_, \_\_\_\_\_, \_\_\_\_\_

Use the following information to answer numerical-response question 3.

A kitchen appliance designer needed to know how well different metals transfer heat. Tacks were attached with wax to four rods of the same length and thickness. The rods were heated for four minutes and the time it took for the tacks to fall off was recorded in the table.



Rod	Time (seconds)
1	360
2	45
3	Did not fall off
4	80

3. Rank the rods from the one having the **poorest** heat transfer to the one having the **best** heat transfer.

Answer: \_\_\_\_\_, \_\_\_\_\_, \_\_\_\_\_, \_\_\_\_\_

Use the following information to answer numerical-response question 4.

Four unknown substances were delivered to a police laboratory. The substances were tested and the observations were recorded in the table.

Test	Substance	Observations
W	An unknown white powder is added to a known colorless solution.	Rise in temperature; the solution turned deep purple in color.
X	An unknown colorless solution is added to a known colorless solution.	Rise in temperature; no change in color; bubbles of gas.
Y	Another unknown white powder is added to a known colorless solution.	No change in temperature; no change in color; white powder disappears.
Z	An unknown white solid is heated for one minute.	Solid disappears leaving a colorless liquid; after cooling, a white solid appears.

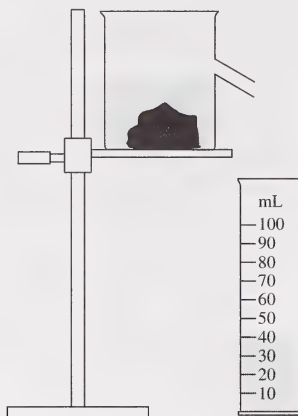
4. For each test, write **1** if the observed change is **chemical** or **2** if the observed change is **physical**.

Answers:

\_\_\_\_\_, \_\_\_\_\_, \_\_\_\_\_, \_\_\_\_\_  
W X Y Z

Use the following information to answer numerical-response question 5.

A crime lab analyst used displacement to calculate the density of a piece of metal. The mass of the metal is 70.0 g. When the metal was added to the beaker, the displaced water overflowed into the cylinder.



5. Calculate the density of the metal in  $\text{g/cm}^3$ . **DO NOT ROUND YOUR ANSWER.**

Answer: \_\_\_\_\_

SECTION OF THE ANSWER SHEET

*You have now completed the test.  
If you have time, you may wish to check your answers.*









